Topography and Physiography

The purpose of this section is to set forth a basic paleoenvironmental profile then explain how our treatment plan will address research concerns that the excavations can answer.

The area of the Yampa and White River Drainage Basins in northwestern Colorado and the Green River Drainage Basin in northwestern Colorado and eastern Utah comprise the main area of interest for the study (Figure 10). This area incorporates two major physiographic units: the Colorado Plateau, and the Wyoming Basin. The Wyoming Basin encompasses the northern section of the study area in Colorado. The Wyoming Basin in northwestern Colorado is enclosed to the east by the Elk Head Mountains and to the south by the large Axial Anticline that extends all the way from the White River Plateau to the Uinta Mountains (Fenneman 1931:138).

The Elk Head Mountains are the product of volcanic activity, typified by "flat-topped remnants of sedimentary rocks protected by sheets of basalt at altitudes 2,000 to 3,000 feet above the plains" (Fenneman 1931:139). The large Axial Anticline that forms the southern boundary of the Wyoming Basin has an axis that has been deeply eroded. This erosion created the Williams Fork Mountains, Duffy Mountain along the anticline, and a large trough to the south of the anticline known as Axial Basin. The western half of this trough is followed by the Yampa River, while the eastern half is crossed by several streams (Fenneman 1931:138). To the north of the Axial Anticline and Elk Head Mountains the Wyoming Basin continues into Wyoming, but for the purposes of this study we will use the Wyoming/Colorado border as an arbitrary boundary. South of the Axial Anticline, the White River drains the Region. To the west Parachute Creek and Douglas Creek feed the White River. Along the Douglas Creek drainage and western tributaries of the White River a sizeable Fremont population once lived.

To the southwest of the Wyoming Basin are the Uinta Mountains. These mountains serve as the northern border of the Colorado Plateau, and our study. The Uinta Mountains "comprise the largest mountain range in the United States that is oriented east to west, measuring approximately 240 kilometers long by 56 kilometers wide" (Reed and Metclaf 1999:7). The Uinta Mountains are typified by a flat-topped anticline that is bounded by monoclines (Fenneman 1931:177). The core of the range is composed of Precambrian quartzite, which has been exposed along the top of the range and the edge of the monoclines by continual erosion (Fenneman 1931:177). Because of the exposure of the more weather resistant quartzite the majority of rivers and streams flow to the north and south away from the crests of the Uinta Mountains. "One feature that is totally out of harmony with the structure is the course of the Green River, which flows across the range from north to south" (Fenneman 1931:178), through the 914 meter-deep Canyon of Ladore. After passing through the Uinta Mountains the Green River heads into the northern section of the Colorado Plateau known as the Uinta

Basin. In this area along the southern flanks of the Uinta Mountains and in areas such as the Browns Park large numbers of Fremont once lived.

The Green River Drainage Basin, south of the Uinta Mountains is part of the Colorado plateau and this river serves as the western boundary of our study area. Within the Colorado Plateau Fenneman (1931) recognizes two subdivisions of the Colorado Plateau; the Uinta Basin and the Canyon Lands. The Uinta Basin subdivision is located to the south of the Uinta Mountains and extends south almost to the Colorado River. "The Uinta Basin is a large structural Depression, or syncline, that has been uplifted" (Reed and Metcalf 1999:8). For the purpose of this study we will only concern ourselves with the easternmost section of the Uinta Basin directly south of the Uinta Mountains, the area that is drained by the White River, and other eastern tributaries of the Green River.

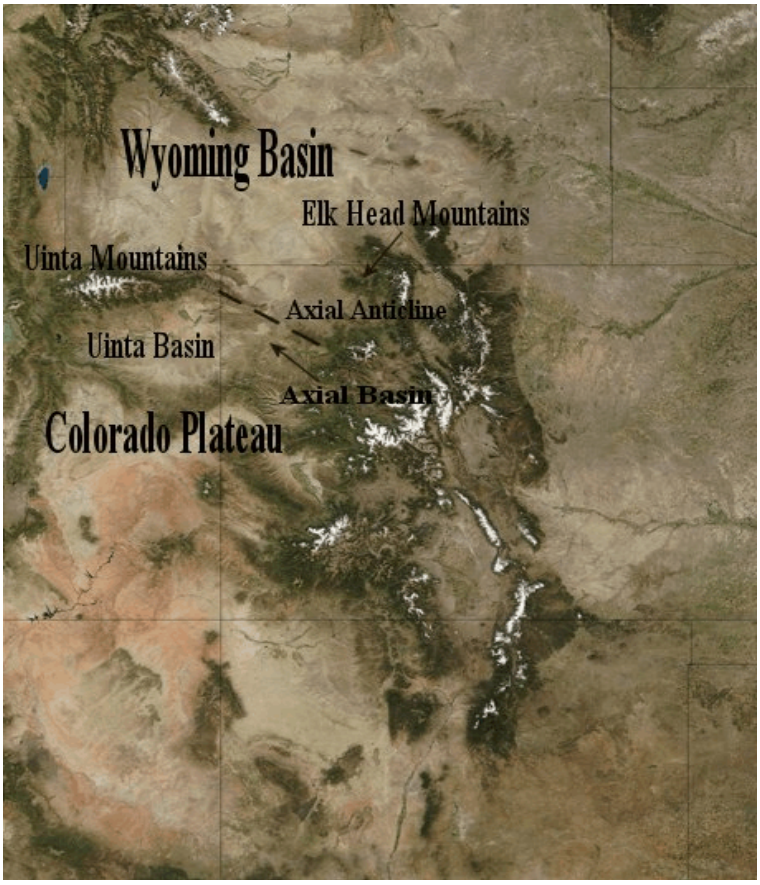

Figure 1. The areas physiographic regions.

Geology

Because of numerous mountain building processes and upheavals the geology of the region is quite complex. Therefore we will only look at a brief overview of the major geological components of the study area. In order to provide a clear organization of the geology of the study area, we look at the study area in two sections; the area north of U. S. Highway 40 and the area south of U.S. 40 in Colorado. We will start in the eastern section of the study area near the Elk Head Mountains in the upper section of the Yampa River drainage basin just north of U. S. Highway 40.

North of U.S. 40

Directly to the west of the Elk Head Mountains the Lance Formation and the Lewis Shale Formation are the dominant geological formations. Both of these

formations originated during the Upper Cretaceous era. The Lance Formation is typified by gray shale, with a few light brown sandstone strata, and a few coal bed strata (Tweto 1976). The Lewis Shale Formation is characterized by a dark gray homogeneous marine shale (Tweto 1976). These formations extend for roughly 15 miles from the Elk Head Mountains to the west before they give way to the Fort Union Formation and Wasatch Formation just north of present day Craig, Colorado.

The Fort Union Formation is Paleocene in origin and is characterized by what has been called a "drab, brown and gray sandstones and shale" that contain coal beds (Tweto 1976). The Fort Union Formation (a relatively small formation) extends for roughly 10 miles to the west at which point the larger Wasatch Formation begins. The Wasatch Formations begins just the north of Craig, Colorado. The Wasatch Formation, north of Craig extends westward to Maybell, Colorado. In this area north of Craig, Colorado the main body of the Wasatch is the dominant formation. This formation is characterized by gray and pink fluvial arkosic sandstone, mudstone, and conglomerates (Tweto 1976). The main body of the Wasatch formation occupies roughly half of the distance between Craig, Colorado and Maybell, Colorado before it gives way to the Cathedral Bluffs Tongue of the Wasatch Formation. The Cathedral Bluffs tongue of the Wasatch Formation is also fluvial in origin characterized by claystones, mudstones, and conglomerates (Tweto 1976). Both the main body and the Cathedral Bluffs tongue of the Wasatch Formation are Eocene in origin (Tweto 1976). Still to the north of U. S. 40 just beyond the Cathedral Bluffs tongue of the Wasatch Formation the Browns Park Formation and Bridger Formation become the dominant formations.

The Bridger Formation begins just past Maybell, Colorado and extends for roughly 15 miles to the west before it gives way to the Browns Park Formation. The Bridger Formation, originating in the Eocene, is marked by its soft gray, green, tan, red, brown, white, yellow, and turquoise-blue fluvial and lacustrine shale, along with mudstone, claystone, siltstone, and minor sandstone and limestone. Within the shale there are also silicified snail fossils and algal heads (Rowley 1979). These deposits served as an excellent source of lithic materials for the areas prehistoric inhabitants. To the west, just past the Bridger Formation is the Browns Park Formation. The Browns Park Formation is Miocene in origin and is characterized by a white to light gray conglomerates that are poorly to moderately consolidated. Along with the conglomerate there are crossbedded, tuffaceous sandstone, siltstone, white crystal-poor rhyolitic air-fall tuff, and a minor limestone (Rowley 1979). The Browns Park Formation heads westward all the way to Dinosaur National Monument were it gives way to the weather resistant Precambrian rocks of the Uinta Mountain Group (Rowley 1979). Precambrian materials are the dominant formation of the Uinta Mountain and the north western section of our study area.

South of U. S. 40

To the south of the Elk Head Mountains south of U. S. Highway 40 is the beginning of the Axial Anticline (Williams Fork Mountains and Duffy Mountain). The

Axial Anticline acts as a very distinct line between the northern Lance and Lewis Shale Formations and the Pierre Shale Formation, which is the dominant formation along the Axial Anticline until it reaches Craig Colorado, at which point the Mancos Shale becomes the dominant formation along the Axial Anticline. Further to the south in the Axial Basin there becomes a mix of Pierre Shale and the Mancos Shale Formation. Both of these formations have origins from the Upper Cretaceous and the Mancos Shale Formation has members which were formed in the Lower Cretaceous (Tweto 1976). The Pierre Shale is typified by dark gray marine shale with a few thick beds of fine grained sandstone (Tweto 1976). The Mancos Shale formation is characterized by gray to dark-gray marine shale with sandstone beds near the top of the formation. The sandstone is calcareous sandstone typically referred to as the Upper Cretaceous Frontier Member of the Mancos Shale Formation (Tweto 1976). Below the sandstone within the formation are two different types of shale, the middle shale is a "calcareous shale zone that is equivalent to Niobrara Formation" (Tweto 1976). The lower shale that forms the base of the Mancos Shale Formation is silver-gray siliceous shale of the Lower Cretaceous and is refereed to as the Mowry Shale Member (Tweto 1976).

Past Craig, Colorado along the Axial Anticline and within the Axial Basin the Mancos Shale Formation becomes the dominant formation and continues westward along the Axial Anticline and Axial Basin until just south of Maybell, Colorado. At this point the Browns Park formation becomes the dominant formation along the Axial Anticline while the upper units of the Mesa Verde Group become the dominant formation within the Axial Basin. The Browns Park Formation continues along the Axial Anticline north westward were it crosses U.S. 40 and eventually comes into contact with the Uinta Mountain Group inside of Dinosaur National Monument. Meanwhile in Piceance Creek Basin (a small western sub-basin of the Axial Basin) the dominant formation becomes the Upper unit of the Mesa Verde Group, a unit that is marked by tan, light-gray, and yellow lenticular crossbedded sandstone and subordinate carbonaceous shale (Rowley 1979). The Upper unit of the Mesa Verde Group remains the dominant formation unit all the way to eastern Uinta Basin, near the Utah Colorado state line. Many of the Fremont Rock Shelters and structures that have been excavated in this area have been found in the Mesa Verde group sandstone.

Just south of the Uinta Mountains, in the Uinta Basin, the dominant formation is an Old Piedmont slope deposit that originated in the Pleistocene. This consists of dissected remnants of alluvial fans deposits and pediment deposits. Mixed in with this Old Piedmont slope deposit is the Brennan Basin Member of the Duchesne River Formation. The Brennan Basin Member is a soft to moderately weather resistant sandstone that is light to medium red, light gray, light brown, yellow, and tan. Intermixed with the sandstone are mudstone, shale, siltstone, and a conglomerate (Rowley 1979). This intermixing of the Brennan Basin Member and Old Piedmont slope deposits are consistent through out the entire northern section of the Uinta Basin: from

the edge of the Piceance Creak Basin to the edge of the Green River which cuts through the Uinta Basin just south of the town of Vernal, Utah.

Located in Northwestern Colorado, the Piceance Basin encompasses 1,600 square miles. The Basin's boundaries are the White River to the north, the Cathedral Bluffs to the west, the Roan and Book cliffs on the south, and to the east the crest of the ridge system that serves as the head of Piceance Creek. The eastern edge is not as clearly defined, but the north south trending ridges, called the Grand Hogback that run from Rio Blanco to the White River, provide a general marker for the eastern boundary of the Basin. The basin general trends from southeast to northwest. The higher elevations, on the south side of this northwest trending down warp, reaches 9,000 feet, while at the north end, where Piceance Creek flows into the White River, the elevation is at 5,700 feet.

D.L. Coffin divides the Basin in five drainage systems. To the south is the Roan Creek drainage, the southeast Parachute Creek, in the middle Piceance Creek, on the northwest Yellow Creek, and to the northeast Little Hills (D.L. Coffin et.al. 1971). The Roan Creek Plateau and the Cathedral Bluffs and Little Hills are rich in bio diversity. The water and food resources in the area made the basin ideal for hunter and gatherers who moved from higher to lower elevations based on the availability of plant resources.

Because of the significance of these areas to the prehistoric inhabitants, James Grady, in his classical study of Piceance Basin, provides a description of the five major drainages (Grady 1981:26-29). His divisions follows Coffin et.al. (1971) and includes two creeks that flow directly into the Colorado River and three that flow north into the White River. From north to south, the drainages as noted above are described in detail below.

Little Hills: This drainage system lies on the northeast side of the Piceance Basin. Most of the creeks in the Little Hills drain west into Piceance Creek, with northwest trending streams flowing directly into the White River. "The Little Hills area is bounded by fairly steep slopes, but once on top, the area tends to be relatively flat or slightly rolling" (Grady 1981:26).

Yellow Creek Drainage: This stream system lies on the northwestern side of the basin. "It consists of Yellow Creek and its tributaries that originate in the Cathedral Bluffs area and drain northward into the White River" (Grady 1981:26).

Piceance Creek Drainage: The "Piceance" drains the heart of the basin. It flows directly into the White River. "Piceance Creek drains the southern most potion of the Cathedral Bluffs and the area north of "the divide." Piceance Creek originates on the east side of the basin in the Grand Hogback.

Grady uses "the divide" to split the basin in two. This division is a logical split as the waters north of the divide flow to the White River and thus to the south to the Colorado River. He defines the divide as: "a major east-west topographic divide that partitions the basin into two dissimilar unites" (Grady 1980:25). The northern half, drained by Piceance, Yellow, and Little Hills streams tends to have flat valley bottoms "that may or may not be incised." Grady goes onto make an observation of the area that reflects an important environmental consideration in the area:

> The valleys tend to be asymmetrical with the north-facing slopes having more and better vegetation and a gentler aspect. Both of these factors are due . . . to the greater moisture retention of the long-surviving winter snow pack. South and west[1] facing slopes and valley sides are steeper and poorly vegetated. These conditions are doubtedly due to lack of snow pack retention and consequent moisture loss (Grady 1980:27-28).

The south and east facing slopes and east facing slopes do have less snow pack over the winter. The angle of the sun prevents direct sunlight from reaching many northern slopes, and the result is more effective moisture reaches the sub soils as the snow melts. A second factor may be that with winds predominately coming from the southwest, evapotransporation rates are lower on sheltered northern slopes than on exposed southern slopes. Whatever the combination of factors are, northern hillsides have more and in Grady's words "better vegetation" (Grady 1980:28).

South of "the divide" there are two major drainage systems: Roan Creek and Parachute Creek.

Roan Creek drains the southwestern portion of the basin. Roan Creek flows southeast and has head waters in the Douglas Creep uplift and the Roan Creek Plateau. Roan Creek drains some of the higher elevations of the basin. On the Roan Creek Plateau, Aspens, Gambles, Oaks, Pines, Strawberries, and a variety of high elevation plant resources can be found. The plateau also has open sage parks that provide excellent grazing in the summer. The east side of the Roan Creek Plateau is drained by Parachute Creek. Parachute Creek also drains the higher elevations of the Piceance Basin.

Parachute Creek drains the southeastern section of the Piceance Basin. It flows south to the Colorado River. Parachute Creek and Roan Creek have "deeply dissected the Roan Plateau, forming ranges with vertical escarpments at the top and steep, v-shaped talus slopes at the bottom." Here a relief of nearly 4,000 feet marks the Roan

[1]Grady faces a dilemma here in that when the Piceance Creek bends north towards the White River, the hillsides or cliffs that face east are generally steep and the east faces received early and mid-day light that lend themselves to more thermal radiation. This is especially the case with southeast facing slopes.

Creak Basin (Grady 1980:29). This roughly dissected section of the basin prevents easy access from the Colorado River valley to the top of the Roan Creek Plateau. The dramatic relief on the north side of the Colorado River represents the southern extremes of the Roan Plateau and the Piceance Basin. Parachute and Roan creeks cut and drain the Plateau southward.

Possibly the Roan Plateau, the top of the Cathedral Bluffs, and the Piceance drainage system reflected an economic utilized by hunter and gatherers moving from north to south. While the Roan Plateau could be accessed from the south, the climb to the top was difficult from the Colorado River Valley. However, traveling from the White River up the Piceance to the Roan Plateau was easier. Looking at the Piceance Basin as a catchment area containing diverse floral and faunal resources helps explain how prehistoric peoples utilized the area. Looking at how prehistoric peoples moved through and lived in the basin helps better explain the evolution of prehistoric populations in the Piceance Basin. Critical to understanding this evolution is understanding when and where people lived in the area. The climate, availability of resources, and topography all played a role in the settlement of the area.

Climate

The Figure Four Environmental Assessment (2004:3-19) provides the most recent summary of climatic conditions in the area. As Tables 1, 2, and 3 indicate, the average precipitation is about 14 inches per year. Winds blow from the southeast through the southwest about 67 percent of the time. The tables summarize the temperature, precipitation, and wind direction.

Table 1
Monthly Temperatures in the Project Area

Month	**Temperature (□F)**	
	Mean Maximum	**Mean Minimum**
January	37	3
February	42	8
March	48	17
April	58	24
May	68	32
Jun	79	38
July	86	45
August	83	43
September	76	34
October	64	24
November	49	14
December	39	5

Month	Temperature (□F)	
	Mean Maximum	Mean Minimum
Annual Average	61	24

Source: Figure Four Environmental Assessment (2004:3-19)

Table 2
Monthly Average Precipitation Amounts in the Project Area

Precipitation in Inches				
Month	Mean	Maximum	Mean Snowfall	Maximum Snowfall
January	0.74	1.87	10.8	33.0
February	0.79	3.09	9.2	30.6
March	1.24	.82	11.5	31.7
April	1.44	3.33	5.1	18.0
May	1.36	3.23	1.1	11.5
June	1.11	3.84	0.1	3.0
July	1.25	3.97	0.0	0.0
August	1.55	4.50	0.0	0.0
September	1.17	5.29	0.1	2.2
October	1.24	4.32	2.4	13.0
November	0.97	2.31	5.9	35.5
December	0.95	2.65	10.5	29.5
Annual	13.82	20.37	86	208

Source: Figure Four Environmental Assessment (2004:3-19).

Table 3
Project Area Wind Distribution

Direction Wind Blowing From	Frequency in Percent	Direction Wind Blowing From	Frequency in Percent
North	2%	South	13%
North-Northeast	3%	South-Southwest	20%
Northeast	2%	Southwest	11%
East-Northeast	2%	West-Southwest	5%
East	3%	West	5%
East-Southeast	5%	West-Northwest	6%
Southeast	6%	Northwest	7%

Source: Figure Four Environmental Assessment (2004:3-19).

In general, the Piceance is relatively well watered. "Ground water occurs in both bedrock and alluvial aquifus beneath the Piceance Basin" (Figure Four Environmental Assessment, 2004:3-12). The aquifer system covers over 700 square miles and contains an estimated 25 million acre-feet of water. There are 25 mapped springs in the Figure Four Assessment Area (2004:3-12 to 3-15).

Vegetation

In northwest Colorado, Pinyon pine (*Pinus edulis*) and Utah Juniper (*Juniperus osteosperma*) woodlands "are widespread between 5,000 and 7,000 feet in elevation." There is some contention that Juniper forests dominate where moisture cones primarily in the form of winter precipitation and Pinyon dominate where there is more moisture from summer monsoons. Juniper can dominate south facing slopes and Pinyon north facing slopes due to more effective moisture reaching the roots of the plant. "Juniper tend to grow at lower elevations and in more arid areas as its scalded foliage allows it to conserve water more effectively than Pinyon pine" (Figure Four Environmental Assessment, 2004:3-25). Both Pinyon and Juniper are located in the Piceance Basin.

Brush or mountain shrubs in the area vary based on elevation and available moisture. Service berry (*Amelanchier alnifolia*), Gambel oak (*Quercus gambelii*) and Mountain mahogony (*Cercocarpus montanus*) dominate but are not the only mountain shrubs. "Mountain shrub communities occur throughout northwest Colorado, typically at elevations between 6,000 and 8,000 feet." Mountain shrubs are commonly found on steep slopes "where there is poor soil development and cold microclimates. . . . There communities are found on nearly all ridges, hillsides and slopes across the area" (Figure Four Environmental Assessment, 2004:3-26). Big sagebrush, common rabbitbrush (*Chrysothamnus nauseosus*) and antelope or bitterbrush (*Purshia tridentata*), are also found throughout the area. The sagebrush steppe, "that occurs through Colorado typically occurs at elevations between 5,000 and 8,500 feet" (Figure Four Environmental Assessment, 2004:3-26).

The types of grasses that are found in the area vary. In some cases they make up the understory of the woodlands, shrubs, or sagebrush parks. In other instances grasses are the dominant species. Grass species noted include: "letterman (*Achnatherum lettermanii*), Columbia needlegrass (*A. Nelsonii*), western (*Pascopyrum smithii*, bearded (*Pseudoroegneria spicata*), beardless blue bunch (*P. Spicata ssp.inerme*), slender wheatgrass (*E. Trachycaulus*), nodding (*Bromus anomalus*), polyuuthus brome (*B. Polyanthus*), onion grass (*Melica bulbosa*), big bluegrass (*Pou pratensis*), various (*Carex spp*), and cheatgrass (*Bromus tectoruml*). The forbs found in the area consist of American vetch (*Vicia Americana var. Americana*) and northern bedstraw (*Galium boreale*), (Figure Four Environmental Assessment, 2004:3-26).

At Eagle Point, due to the nature of the cliff and surrounding topography, there is some variability in the vegetation. One component of the vegetable community is

barren rock outcrop. While barren is a term too readily applied to areas with sparse vegetative cover, it does not imply no plant life. Here lichens, phlox, flowering plants, and “rare plant species” can be found (Figure Four Environmental Assessment, 2o04:3-27).

The final plant community in the project area includes an Aspen woodland. These woodlands may have pine trees in the grooves but most commonly they consist of “Quaking aspen (*Populus tremuloides*). These grooves are found at between 7,500 and 10,500 feet in areas that receive over 14 inches of effective moisture annually (Figure Four Environmental Assessment, 2004:3-27). It is important to look at water and plant communities as critical resources required for successful settlement of the Piceance Basin by prehistoric peoples.

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[2] This changed in 2003 so that now names are written out instead of abbreviated. For example, Binford, L. R. Would appear as Binford, Lewis R. As per the new guidelines we will initiate this transition in our reports. This will initially cause some mixed styles in the bibliography as the changes are reflected in post 2003 reports.

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